

CONDITION OF BREAKWATER AT BURLINGTON, VT.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

IN RESPONSE TO CONCURRENT RESOLUTION OF THE SENATE OF
JANUARY 8, 1901, REPORT OF COL. J. W. BARLOW, CORPS OF
ENGINEERS, ON THE CONDITION OF THE BREAKWATER AT
BURLINGTON, VT.

JANUARY 23, 1901.—Referred to the Committee on Commerce and ordered to be
printed.

WAR DEPARTMENT, *January 23, 1901.*

SIR: In response to concurrent resolution No. 89, dated January 8 instant, directing the Secretary of War "to furnish Congress with a report showing the present condition of the breakwater at Burlington, Vt., with an estimate of cost for its proper repair and completion," I have the honor to transmit herewith a letter of this date from the Acting Chief of Engineers United States Army, submitting copy of report of Col. J. W. Barlow, Corps of Engineers, on the subject, dated December 20 ultimo.

Very respectfully,

ELIHU ROOT,
Secretary of War.

The PRESIDENT PRO TEMPORE UNITED STATES SENATE.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, January 23, 1901.

SIR: I have the honor to return herewith concurrent resolution of Congress, as follows:

Resolved by the Senate (the House of Representatives concurring), That the Secretary of War be, and he is hereby, directed to furnish Congress with a report showing the

present condition of the breakwater at Burlington, Vermont, with an estimate of cost for its proper repair and completion—

and in compliance with the terms of said resolution to submit the accompanying copy of report dated December 20, 1900, by Col. J. W. Barlow, Corps of Engineers.

Very respectfully, your obedient servant,

A. MACKENZIE,
Acting Chief of Engineers.

Hon. ELIHU ROOT,
Secretary of War.

CONDITION OF BREAKWATER, BURLINGTON HARBOR, VERMONT.

UNITED STATES ENGINEER OFFICE,
New York City, December 20, 1900.

GENERAL: I have the honor to submit the following special report upon the condition of the breakwater at Burlington, Vt.

This breakwater is built in Lake Champlain in front of the city, and forms a harbor for the protection of the wharves and shipping at this point.

The length of the main structure is 3,803 feet, and there is also a detached section 350 feet long, placed 200 feet north of the main section.

The substructure of the entire work is of timber cribs filled with stone and was built at different periods from 1836 to 1890, the last work being the detached section. Its trace is very irregular, the object apparently being to follow a line approximately parallel to the shore. The width of the breakwater varies from 24 to 36 feet, its height being 8 feet above low water, and the depth of water is about 30 feet.

The character of the work also varies with the date of construction, the older parts being largely of round timber fastened with wooden pins, while during more recent periods squared timber, iron bolted, was used.

Originally the superstructure was of timber and stone, the cross section varying from the full width of the cribs to a narrow parapet on the lake side, 10 or 12 feet wide.

In recent years some portions of the decayed timber superstructure have been replaced by a stone parapet, 24 feet wide at base, with sloping sides. The interior portion of this parapet was composed of riprap and the sides and top surface formed of large stones. On the lake side these slabs of stone rest against the upper timbers of the outer wall, producing more or less thrust, which in some cases proved to be greater than the wall could resist. Doubtless vibrations in the structure during heavy storms added materially to the strain. The result has been that the outer wall has given way in places, allowing the large stones to slip into the lake and exposing the core of riprap to destruction. So serious had this damage become in one of the sections that emergency repairs were made during the present season, but owing to the advent of very severe weather the work was only partially completed.

During the past season a section of concrete superstructure has been built to replace a part of the decayed and crumbling timber work. It is a monolithic arch having a rubble core, and rests upon concrete footing blocks, which were placed upon a carefully prepared foundation below the water surface. The width at bottom is 16 feet, and the top is 8 feet above low water.

The outer line of footing blocks is nearly flush with the lake wall of the substructure; but on the inner side a considerable berm was left, which was intended to be covered with planking below the surface of the water.

Several storms of rather more than usual violence have occurred during the late autumn, which have seriously tested the entire superstructure and have caused much damage at several places.

It was expected that the old and rotten timber work would suffer, but the damage to the more recent stone parapet was also serious, and, as stated above, considerable immediate repairs were made upon one of the sections to prevent greater destruction.

The concrete section had been in place but a few days when a heavy storm came up, but it sustained no injury whatever, though the plank decking back of it which was not fully fastened down was torn away, carrying with it some of the timber structure below. This result was due to the character of the old work, as it was afterwards discovered that the wooden pins and dovetails which were intended to hold the timbers in place had become so worn by the action of the waves during a period of over fifty years that there was practically no connection between the upper courses of the old timbers. How far down this defective condition extended was not ascertained, but a careful examination will be made in the spring to discover this fact.

I have carefully examined the entire superstructure of this breakwater during the past season and my assistant, Mr. Kelsey, was directed to make a report of its condition. I am therefore enabled to state that the entire superstructure should be rebuilt in a substantial manner within the next few years, and that about 2,100 feet thereof should be reconstructed at the earliest possible date. This is necessary to preserve the main work and protect the wharves of the harbor from damage by storms. I therefore recommend that the matter be submitted to Congress with a view to obtaining a suitable appropriation to carry on the work continuously until completed, and would further recommend that the new work be of concrete, substantially in accordance with the section now in progress.

Under the present contract the concrete superstructure is costing about \$30 per linear foot, but as it may not be possible to secure as low bids another season on account of the unforeseen expense of tearing down the old work and preparing the foundation for the new superstructure, I now estimate the cost at \$35 per linear foot, which is still less than was paid for the stone parapet last constructed.

The length requiring immediate renewal is 2,100 feet, less 450 feet now under construction, leaving 1,650 feet, which, at \$35 per foot, will require \$57,750. The work should be provided for under one appropriation or else put under the continuous-contract system, so that there will be no delay in completing it, otherwise great damage may happen to the breakwater, which would require a far greater expenditure in repair work than is now proposed.

In addition to the above, provision should be made for the reconstruction of the remainder of the superstructure, 2,053 feet, which, at \$35 per foot, will cost \$71,855. The expenditure of this amount will probably be required upon the completion of the work now urgently needed.

Very respectfully, your obedient servant,

J. W. BARLOW,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers U. S. A.

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